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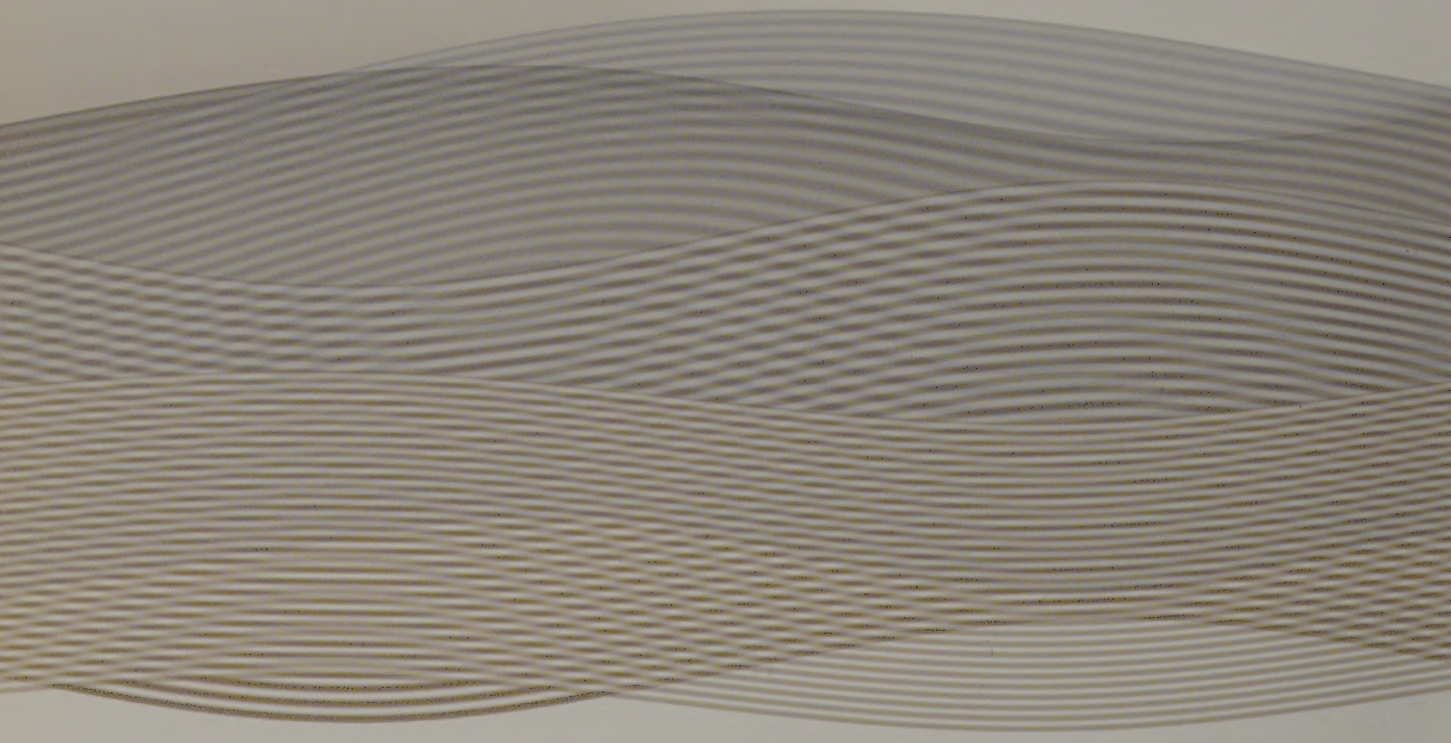
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EUROPEAN COMMISSION
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Report EUR 20659 EN



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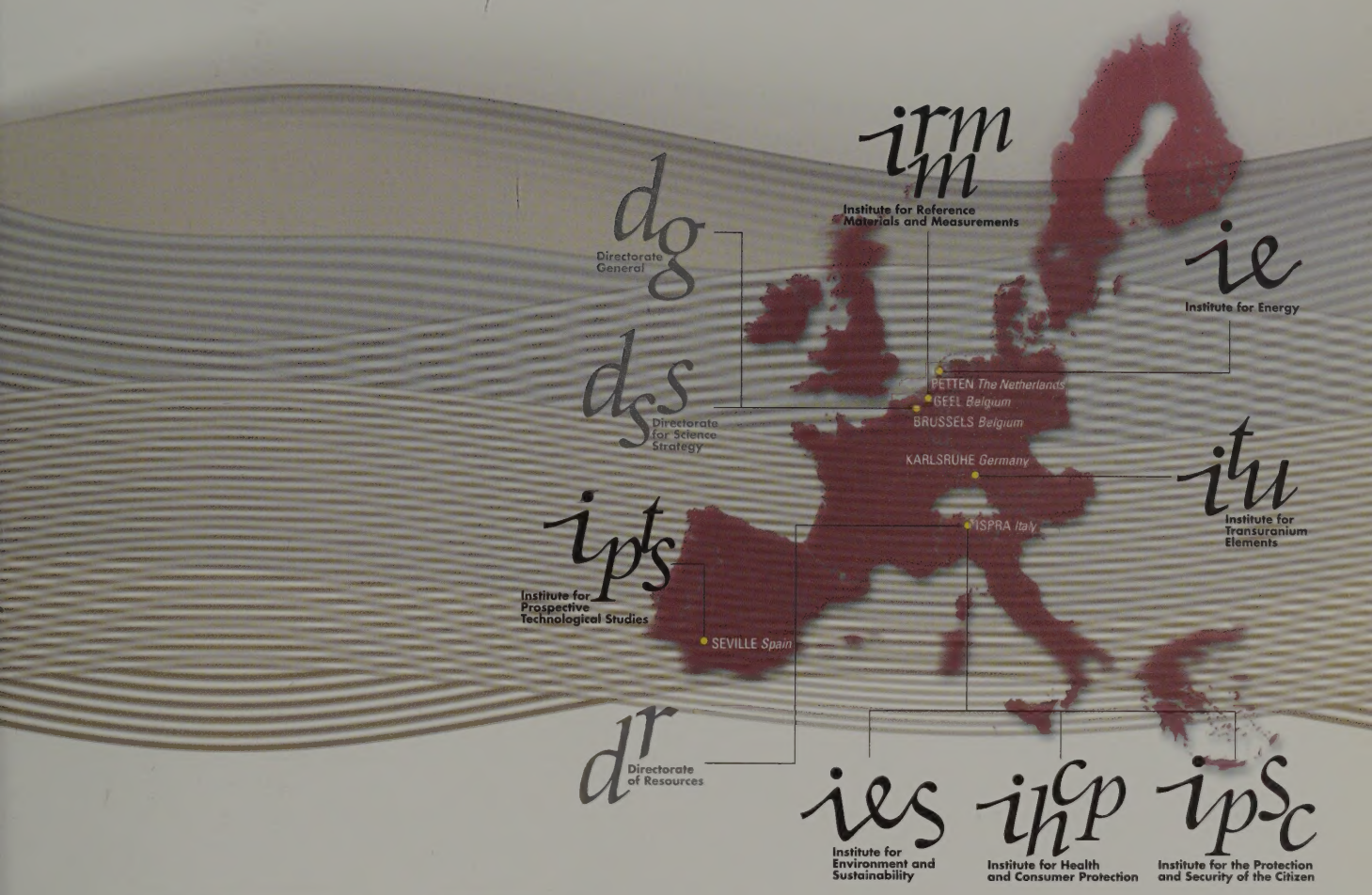
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JOINT RESEARCH CENTRE
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The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Community. Close to the policy-making process, it serves the common interest of the Member States, while being independent of commercial or national interests.

ANNUAL REPORT 2002

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Contents

Foreword from the Commissioner for Research 4

Observations from the Board of Governors 5

Message from the Director-General 6

Direct support to Community policies 8
- Chemicals policy support 10
- New European Network of GMO (Genetically Modified Organism) Laboratories (ENGL) 11
- Sustainable agriculture and food safety 12
- Sustainable fisheries – control and enforcement 13
- Water Framework Directive 14
- Reaction to emergencies 15
- Prospective studies on enlargement 16
- Safety of Central- and Eastern-European nuclear reactors 17
- New Minor Actinide laboratory fosters innovation in nuclear waste management 18
- Non-proliferation and nuclear safeguards 19

Scientific excellence 20
- Awards to JRC young scientists 22
- Awards for best publications 24

Contributing to the European Research Area 26
- ERA Action Plan 27
- Support to enlargement 28
- Support to the GMES initiative 29
- FP6 and the multi-annual work programme 30
- Technology transfer 32
- The High Flux Reactor supplementary programme 33

Decommissioning of JRC nuclear installations 34
- The present status 35

The JRC in figures 36
- Human and financial resources 36

Appendices 38
- Members and participants of the JRC Board of Governors 38
- The JRC Directors 40

Foreword from the Commissioner for Research

Europe has a distinguished history in science and today produces just over one third of the world's scientific publications. Nevertheless, there are several issues of concern that need to be addressed, issues that impinge upon the fact that Europe holds second place on the scale of world scientific research. For example, today Europe assigns only 1.9% of its GDP to research whilst Japan allocates 3.0% and the USA 2.7% – with the latter figures rising. One obstacle for European research is the dispersion of effort and lack of coherence due to the inevitable fragmentation within and between the different countries. The European Research Area (ERA) was founded to help counteract this obstacle and it aims to make the Union the most competitive and dynamic knowledge-based economy in the world.

Though still in its infancy, ERA will play a key role in strengthening European research and the JRC, through its core areas of scientific competence, can play a catalytic role in its development and evolution. To this end, the JRC developed an ERA action plan in 2002 that focuses on its contribution to common scientific reference systems, networking, enlargement, training and mobility, and increasing access to specialised facilities. I attach particular importance to the promotion of common scientific references and methods, such as the new European Network of Genetically Modified Organism (GMO) Laboratories, as these provide the basis for a concerted approach to solving transnational problems and to facilitating business and trade both within and beyond the Union.

Building on its expertise in matters of health, safety and the environment, the JRC continued in 2002 to provide scientific and technical support to the European Union (EU) in the formulation and implementation of Community policies. A clear focus both on policy support and ERA is strongly reflected in the priorities of the JRC multi-annual work programme (2003-2006) for the Sixth Framework Programme (FP6). Working closely with scientists, national research organisations and businesses throughout Europe, it adds value to Member State initiatives and contributes to the enlargement process through supporting candidate country integration into the EU.

The JRC's activities in 2002, as documented here, demonstrate how it intervened and helped solve EU policy related scientific problems, how it progressed towards enlargement and contributed to the preparation of ERA. I have also observed with pleasure that the JRC is becoming a dynamic and results-oriented organisation, with more focus, more customer orientation and timely delivery of high-quality results. I am confident that the JRC will make a valuable contribution to the creation of ERA and thereby contribute to European scientific excellence.

Philippe Busquin
Research Commissioner



Observations from the Board of Governors

During 2002, the JRC focused on the preparation of its multi-annual work programme for 2003 to 2006 and defining its role in the European Research Area and its contribution to enlargement. The increased interaction with and consultation of both the High Level Group of User DGs and the JRC's Board of Governors contributed significantly to the overall content of the work programme. The new Deputy Director-General, Dr. Roland Schenkel, and the new Director of the Institute for Transuranium Elements in Karlsruhe, Dr. Gerard Lander, were appointed with the involvement of the Board of Governors in their selection. The Board also endorsed the internal restructuring of senior management in the JRC which was carried out in an efficient and smooth way.

The quest to improve efficiency of services was also continued through development of a time accounting and project management system. The Board of Governors appreciates the JRC management's efforts to rationalise the administrative tasks and reduce costs and to make best use of its human and financial resources.

In this context, the Board makes the following observations for the year 2002:

The provision of sound scientific and technical support to EU policies continued in line with JRC's mission with particular examples given in this report. Increased user-orientation was evident in the preparation of the JRC's multi-annual work programme, and the Board of Governors acknowledges that the JRC has taken into consideration the recommendations of the Board and its Working Groups and that the new work programme will be effective in serving EU policies and ensuring necessary scientific excellence. We believe that the new structure of Integrated Scientific Areas (ISAs) will make better use of JRC multi-disciplinary competencies and enhance the cohesion and focus of the JRC activities.

The Board also acknowledges the JRC's potential to contribute strongly to the aims of the European Research Area in strengthening the EU's position in international research. The JRC ERA Action Plan, developed jointly by the Board and the JRC management, sets out ambitious targets focusing on the JRC's ability to contribute via Common Scientific Reference Systems, increased networking, targeted multi-disciplinary training and mobility, and broadening access and use of JRC's specialised facilities. A further aim of the ERA is meeting the challenge of an enlarged Europe. The Board recognises the results of the JRC programme on "Collaboration and advanced training" in 2002 which through a series of dedicated workshops and training sessions involved more than 1000 scientists from Candidate Countries.

The JRC's main asset is its highly qualified staff, and the Board applauds the initiative taken in 2002 to recognise scientific excellence through young scientist and best publication awards. The Board's own discussions during the year benefited considerably from direct interaction with staff representatives as a part of our meetings.

The Board welcomed and endorsed the move to give the JRC responsibility for the management of the Communities' intellectual property. The JRC will undertake actions to protect and transfer its own results to the market and to develop its networks throughout Europe to foster best practice on innovation and technology transfer.

The Board of Governors notes that the JRC's role in nuclear-related activities presents various challenges, notably the management of JRC's own nuclear waste and the decommissioning of some of its nuclear facilities. The Board of Governors encourages the JRC to continue using its know-how and competency in this field to accomplish its mission and looks forward to the future development of the operation of the High Flux Reactor.



Fernando Aldana
Chairman

Message from the Director-General

The year 2002, the aftermath of JRC realignment and focusing of activities, was one of consolidation and quantifiable success. This success came in terms of the inauguration of a European Network of 45 GMO laboratories and a new Minor Actinide laboratory to formulate safe solutions to nuclear waste, and in effectively using satellite imagery for sustainable agriculture, fisheries, environmental protection and alleviating European crises such as floods and oil spills. There was success also in terms of further extending common scientific reference systems, such as BSE test evaluation, to the candidate countries and extending our scientific base and networks to the East in order to enhance nuclear safety and security. And success, on a different level, was achieved by preparing the FP6 multi-annual work programme so that it enhances integration between our seven institutes and, together with the ERA action plan, outlines our commitment to contributing towards the European Research Area.

I would like to highlight some outstanding achievements by young JRC scientific staff during 2002. As appraised and judged by the JRC Scientific Committee, this year's Young Scientist of the Year Award went to Francesca Campolongo for producing original theoretical scientific work in the field of mathematical modelling and, in particular, on uncertainty and sensitivity analysis of model output. Young Scientist Awards for scientific innovation were made for research in the areas of biomedical technology and environmental research. The Scientific Publication of the Year Award produced an overall winner with a paper on the "Determination of Deforestation Rates of the World's Humid Tropical Forests" published in *Science*. Three further papers were judged to have outstanding innovative scientific content, namely: "Fission of actinides using a tabletop laser" published in *Europhysics Letters*; "Neutron-Induced Fission Cross Section of ^{233}Pa between 1.0 and 3.0 MeV" in *Physical Review Letters*; and finally "Plutonium-based superconductivity above 18 K" published in *Nature*. These examples show that scientific excellence is high on JRC's agenda and I am delighted to foster this aspect as a cornerstone of credible support to Community policies.

To turn briefly from scientific matters, the JRC will also remember 2002 as the year that one of its Institutes received one of three prizes for best "Financial Authorising Officer" across the whole European Commission. This reflects very positively on the management support unit involved. The basis for this award was the appraisal of "sound and efficient management" and, as such, this further consolidates the reputation of the JRC as a reliable place to do business. There are also many unsung heroes who provided excellent service in both the technical and administrative domains and, in 2003, we will introduce a recognition scheme in these areas as well.

In 2002, the number of short-term staff increased to 591 compared with 494 in 2001. I am pleased with the progress we continue to make in attracting excellent scientists from Member States, candidate countries and elsewhere to work in the JRC for temporary periods of up to three years. I now look forward to the start of the new Framework Programme with the expectation that the JRC will make a strong and reliable scientific and technical contribution to the conception, development and implementation of EU policies.

To conclude, I extend my sincere thanks to all JRC staff, to our customer DGs and to all our partners.

Barry McSweeney



Direct support to Community policies

The Joint Research Centre (JRC) is a Directorate-General (DG) of the European Commission serving the European Union (EU) as a whole. Its role is to support EU policies by providing independent scientific and technical support to the Commission, the European Parliament, the Council and the Member States – with the overall objective of helping to create a safer, cleaner, healthier and more competitive Europe.

The JRC carries out research of direct concern to European citizens and industry. As a Commission service, it maintains independence from private or national interests, which is crucial in pursuing its mission. Over the years, the JRC has developed skills and tools to provide autonomous and Europe-wide expertise that brings improved understanding of the links between technology, the economy and society. Examples of areas where JRC scientific and technical support was provided in 2002 are described in the following pages.

Examples of policy support in 2002

EC Regulation 765/2002 on Beef Gender Testing

Mining waste initiative – Environment DG/European Integrated Pollution Prevention and Control Bureau (EIPPCB)

Environmental Technologies for Sustainable Development, COM (2002) 122 European Council (Barcelona)

Communication from the Commission on Impact Assessment COM (2002) 276

Communication on the implementation of the Pressure Equipment Directive COM (2002) C 62/04

Biofuels Directive COM (2002) 508

Environmental Technologies Action Plan of the European Union COM (2002) 122

Communication of the Commission to the Council and Parliament: civil protection - progress made in implementing the programme for preparedness for possible emergencies COM (2002) 302

Communication of the Commission on the 3% target for R&D spending COM (2002) 499

Commission Decision C (2002) 4287 for the European Atomic Energy Community to (1) adhere to the Generation IV International Forum, and (2) to conclude a technical exchange and cooperation agreement with the Department of Energy of the United States of America

Joint Communication (Copenhagen Council) of the Council and the Commission: Draft programme to improve co-operation in the European Union for preventing and limiting the consequences of chemical, biological, radiological or nuclear terrorist threats (15905/02)

Communication to the Copenhagen Summit (December 2002) on "Barriers to widespread access to new services and applications of the information society through open platforms in digital television and third generation mobile communications" SEC (2002) 1333

Communication from the Commission to the European Parliament and the Council on "The European response to the flooding in Austria, Germany and several applicant countries" COM (2002) 481

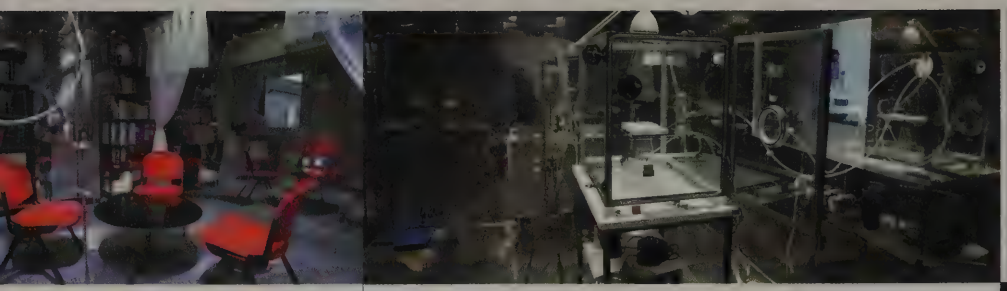
Communication on a life sciences and biotechnology strategy and action plan COM (2002) 27

Communication to the Commission on structural indicators COM (2002) 551

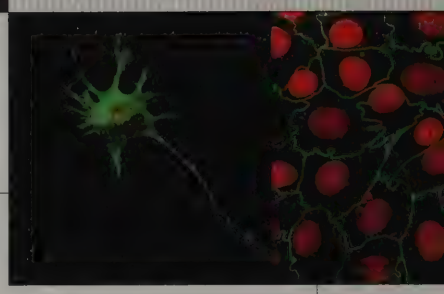
Internal Market Scoreboard that will be used in the Communication on the tenth anniversary of the Internal Market COM (2002) 309

Operation of the Euratom Safeguards Office in 2001 COM (2002) 566

Amendment to the Seveso II Council Directive 96/82/EC on the control of major accident and hazards involving dangerous substances COM/2002/0540



Special exposure chamber positioned in the INDOORTRON for measuring the photo-induced degeradation (UB-A) of gaseous pollutants on photo-catalytic surfaces containing TiO_2



Immunofluorescent staining of tight junctions (green) and nuclei (red) of renal proximal tubular epithelial cells (LLC-PK1)

Genetically engineered PC12 neuron-like cells overexpressing p53 protein (box width 210 μm)

Chemicals policy support

The chemicals industry is one of the most important manufacturing industries in the EU. Chemical sales alone amounted to € 488 billion in 2001 and about 3 million people are employed, either directly or indirectly, by the chemicals industry in the EU. In February 2001, the Commission, after consultation with all stakeholders including chemical producers, industrial users, citizens' groups and animal welfare organisations, issued a White Paper outlining its chemicals policy strategy. Currently, the Commission is in the process of establishing a single review and testing system called REACH (Registration, Evaluation and Authorisation of CHemicals) for all existing and new chemicals.

The JRC European Chemicals Bureau (ECB) provides scientific and technical support for developing and implementing EU chemicals policies with the Environment and the Enterprise DGs, by classifying, labelling and evaluating the risks of chemicals to humans and the environment. The ECB has highlighted a lack of basic data on industrial chemicals and in 2002 it completed ten risk assessments for existing substances and processed some 350 notifications for new substances. The ECB is actively developing methods for continuous improvement in predicting and assessing risks posed by chemicals.

Methodological and data deficiencies on human exposure represent a major bottleneck in the risk assessment process. The JRC's Physical and Chemical Exposure Unit (PCE) is developing methods for improving the characterisation of human exposure to chemicals. In 2002, PCE was requested by the Health and Consumer Protection DG to develop and operate a European Information System on Chemical Risks. EIS-CHEMRISKS will systematically collect, store, and assess information on human exposure to chemicals released from consumer products/articles.

The JRC also validates cost-effective alternative testing methods, i.e. methods that reduce, refine or replace the use of animals. The JRC's European Centre for the Validation of Alternative Methods (ECVAM) coordinates and funds (pre-)validation studies and carries out research in several areas of toxicology relevant to the testing of chemicals (including cosmetics and pharmaceuticals), which ultimately leads to a greater protection of human health. In 2002, ECVAM organised several meetings of the ECVAM Working Group on Chemicals and published a report in *ATLA* (Alternatives To Laboratory Animals) in July 2002 entitled "Alternative (non-animal) Methods for Chemicals Testing Current Status and Future Prospects".

New European Network of GMO Laboratories (ENGL)

Genetically modified organisms (GMOs) are the focus of intense public and political debate with concerns about the safety of both food and the environment. EU consumers have convincingly expressed their desire to know if the food they eat, buy and/or sell has been genetically modified. In the most recent Council conclusions, it has been decided that food or food ingredients containing GMOs in concentrations above 0.9% must be labelled. Two scientific cornerstones for implementing EU labelling requirements are the development of robust and reliable analytical methods for the identification and determination of GMOs in food and foodstuff, and the availability of certified reference materials (measurement standards) to ensure measurement standardisation and the promotion of fair trade.

The JRC produced the world's first certified reference materials for GMOs and has delivered some 100 000 samples to external laboratories so far. With globally recognised expertise in GMO risk assessment, the JRC has also developed and validated methods for identifying and determining levels of GMOs in food and foodstuff.

On 4 December 2002, Commissioner Philippe Busquin inaugurated the European Network of GMO Laboratories (ENGL – http://engl.jrc.it/). Coordinated by the JRC, this network consists of 45 EU control laboratories (about 450 experts) and has the mandate to examine the different GMO put on the market and to ensure that all national control laboratories can trace them throughout the food chain. In effect, ENGL has been set up to create a forum for EU Member States, Enlargement Countries, the European Economic Area, Switzerland and others, to collaborate on sampling, detection, identification and quantification of GMOs.

In the short term, ENGL will yield reliable and comparable GMO test results and thus avoid trade confusion and litigation while promoting consumer confidence. In the long term, ENGL aims to become a scientific and technical European network of excellence within the context of EU GMO legislation. The network is already inviting future Member States to participate in working groups and is interacting with EU global trade partners.

Finally, the Commission has nominated the JRC to become the Community Reference Laboratory for GMOs in food and feed regulations.



Inauguration ceremony of the European Network of GMO Laboratories (ENGL)



Sustainable agriculture and food safety

European consumers attach increasing importance to the safety and quality of their food supply and to production methods throughout the food chain. These issues are targeted in the discussions on the Common Agricultural Policy (CAP) reform. Increased food safety is part of a more sustainable agriculture. The JRC's role relates to sustainable development, cleaner energy and a better quality of life through food safety, health and security.

To be more specific, the JRC contributes to the traceability of food and the assessment of sustainable agricultural production practices. For example, the demand for organic food is growing, with consumers becoming more conscious about the types of fresh product they eat and how it is grown. With most Member States calling for common inspection rules, organic food and farming is certainly under the spotlight. However, despite some attempts to distinguish conventional from organic food (pesticide and nitrate content), little focus has been put on compliance with labelling and an EU-wide harmonised approach.

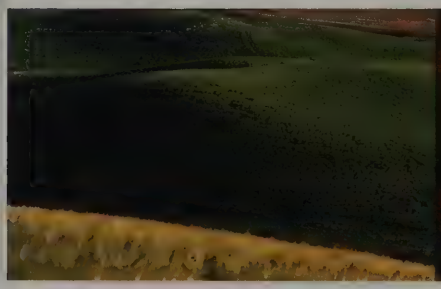
In response, the JRC is presently performing a feasibility study on the possibilities to detect differences between organic and conventional food products. In 2002, the establishment of a database on certification organisations, inspection bodies and organisations involved in organic agriculture got under way. Furthermore, a survey was performed on analytical methods developed to assess organic food, and an ongoing survey on the contamination level of mycotoxins in breakfast cereals deriving from organic production will be finalised in early 2003. The JRC also started networking with laboratories, industry, public institutes and universities from Member States, candidate countries and Switzerland. Also in 2002, the focusing of activities in the JRC saw the inter-institute transfer of food products activities to the Geel site and therewith the creation of a new Food and Feed Unit which aims to attain a critical mass for food safety research. Main activities include the detection/determination of allergens, mycotoxins, acrylamide, cocoa butter, polychlorinated biphenyls and dioxins, meat and bone meal, and central nervous tissue in food and/or feed.

Further support to sustainable agriculture is carried out via Monitoring Agriculture with Remote Sensing (MARS). The MARS-STAT action line focuses on a crop yield forecasting system, based on meteorological analysis, crop growth indicators and low-resolution satellite-based information. The main cereals (wheat, barley and maize) and oil seeds (rapeseed and sunflower) are assessed for the entire European continent, the Maghreb region and Turkey. The system produces quantitative forecasts, which are used as official references by the European Commission and for outlook analyses in support of CAP decisions. The MARS FOODAID action line brings these systems outside the EU (e.g. South America, Africa) and, finally, MARS PAC deals with remote-sensing control which is used for the detection of errors in the area-aid applications that EU farmers file every year with their national administrations.

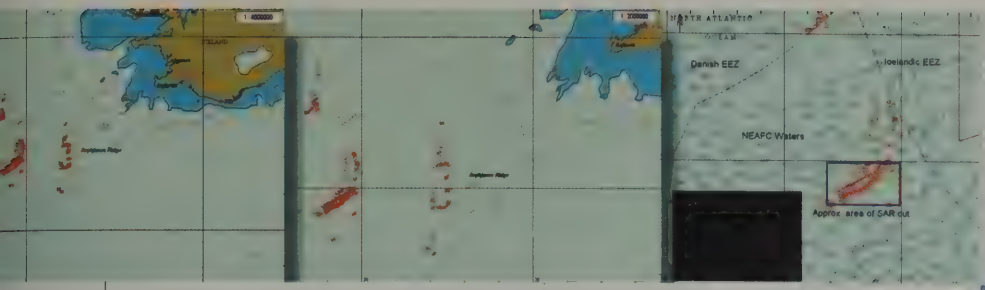


a. *Mycotoxins in food*

b. *Reference material on food*







Vessels detected in RADARSAT images in North-East Atlantic Fisheries Convention waters, June 2002



Fishermen want efficient regulations with equal treatment through out the Community

Sustainable fisheries – control and enforcement

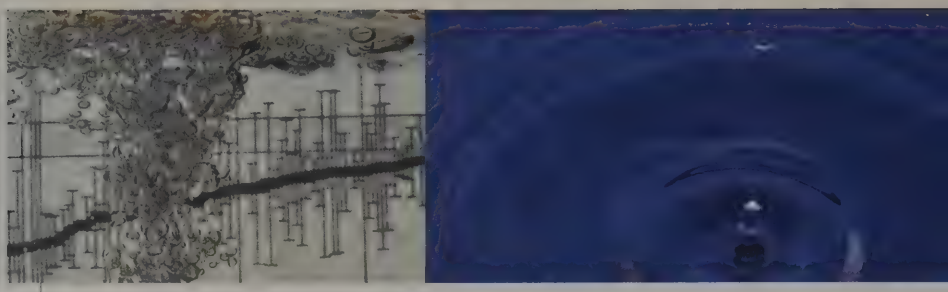
It is now almost universally accepted in the scientific community that over-fishing and inappropriate fishing practices have been responsible for both local fish stock collapses and dwindling global catches. The solutions proposed, both by the Commission in its reform of the Common Fisheries Policy and by the recent World Summit on Sustainable Development at Johannesburg, include improved reporting, enforcement and control of fishing vessels.

The EU's main instrument for monitoring the position of fishing vessels is the Vessel Monitoring System (VMS), which is compulsory for all vessels over 24 metres either registered in the EU or fishing in EU waters. This on-board system transmits the vessel's position to the flag state and the coastal state on a regular basis – the typical period between reports being about an hour.

The JRC has been investigating how satellite imagery can help detect and identify vessels whose VMS is not functioning. Trials in the Flemish Cap, North Sea, Bay of Biscay and the Azores showed that analysis of synthetic aperture radar (SAR) images from the Canadian RADARSAT satellite could allow the detection of virtually all steel-hulled boats subject to VMS. By correlating their positions with VMS-derived positions, vessels not carrying VMS could be identified. In 2002, the JRC coordinated a partnership involving industry, research organisations and fisheries authorities which undertook pilot tests in Rockall, Cantabrico and the North-East Atlantic Fisheries Convention (NEAFC) redfish fishery. The Cantabrico region includes two areas where fishing has been stopped for conservation purposes.

The new study concentrated on: reducing the sea-noise in the images so as either to allow smaller vessels to be detected with the same image or to permit the use of lower resolution images and thus increase the stretch of ocean covered by each image; and on improving the speed with which information can be sent to the authorities. It was found that the SAR processors used at certain ground stations were more effective at noise reduction than others. Following experimentation at the JRC using unprocessed images, recommendations were issued for the following year's studies. Response speed was increased by automation of algorithms and, in December 2002, a high bandwidth satellite communication link was established between the ground station at Tromsø, Norway and Ispra. Finally, Council Regulation (EC) No 2371/2002 of 20 December 2002 obliged Member States to include the capability for using satellite-based systems in their monitoring infrastructure.

The JRC is also supporting Commission efforts to develop a secure harmonised logbook for better reporting of catches and, together with other European partners, is establishing a database of the genetic characteristics of European marine fish.



Measurement evaluation results of trace elements in water

Water Framework Directive

In December 2000, the European Parliament and Council adopted a directive establishing a framework of community action in the field of water policy – the Water Framework Directive (WFD). The main objectives of the WFD are to ensure sustainable water use throughout Europe, and to achieve a "good status" for all European surface and ground waters by 2015.

The implementation of the Water Framework Directive raises a number of shared scientific and technical challenges. Management objectives to be achieved in the river basin need to be identified, developed and implemented, based on an analysis of the impact of human pressures on the "status" of all waters within the river basin. Programmes of measures needed to achieve these objectives must take economic considerations into account and be agreed upon. In the WFD, some key concepts – including the "good status" comprising its main environmental objective – are only defined in very general terms, and require a common understanding based on state-of-the-art scientific knowledge. Harmonised or at least intercalibrated assessment methods are required to quantify the chemical and ecological status.

The JRC is playing and will continue to play a major role in the Common Implementation Strategy (CIS) of the WFD, in support of the European Commission, Member States and candidate countries. The aim of the CIS is to allow, as far as possible, a coherent and harmonised implementation of the Directive. The focus of the CIS is on information sharing, developing guidance on scientific and technical issues, information and data management, and application, testing and validation. More than 500 experts from Member States and candidate countries, the JRC, the European Environment Agency (EEA) and the Environment DG are involved in the CIS.

In 2002, the JRC coordinated two of the major CIS Working Groups (WGs) in collaboration with the Environment DG, namely the Intercalibration and GIS/Reporting groups. The JRC also acted as Technical Secretariat for the WG on Pilot River Basins, and contributed scientific and technical expertise to other CIS WGs. The JRC coordinates the WG on Analysis and Monitoring of Priority Substances (AMPS) leading to a harmonised monitoring strategy for chemicals in EU waters. The main products of these WGs in 2002 were a series of comprehensive guidance documents approved by the Environment DG.

In 2002, the JRC was involved in the development of environmental indicators for coastal and inland water eutrophication, data gathering, analysis and modelling of river basins, as well as the development and implementation of advanced chemical monitoring techniques and protocols. It was also engaged in the linking of remote sensing and three-dimensional coastal modelling for environmental indicator development, the use of remote sensing to determine status and trends of coastal waters, and the modelling of land-ground water interactions. In November 2002, after consultation with the Environment DG and the Member States, the JRC launched the European Centre for Ecological Water Quality and Intercalibration (EEWAI) to serve as an umbrella for the intercalibration exercise and to act as a focal point for research on ecological quality assessment.

The JRC is committed to contributing to the long-term implementation of the WFD through to 2009 providing key support to EU water policies, and research on key scientific and technical questions.

Reaction to emergencies

Devastating floods in Central Europe. In recent years, severe flooding has taken place in Europe. For example, in 1993 and 1995, flooding took place in Belgium, France, Germany and the Netherlands. In 1997, the Czech Republic, Germany and Poland were affected, Italy in 1994 and 2000, and the UK in 1998 and 2000.

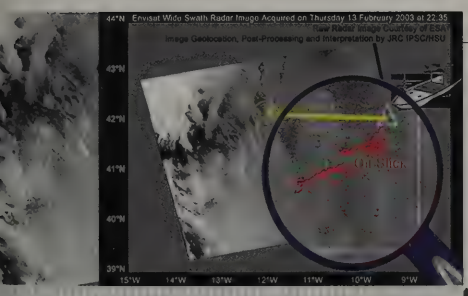
In August 2002, floods yet again devastated the Elbe and the Danube Basin. The JRC was alerted and promptly produced and delivered daily forecast simulations on the evolution of the floods; this information was disseminated via the Environment DG's Monitoring and Information Centre to the civil protection authorities in the Member States and candidate countries. The basis for the simulation was a computer model (LISFLOOD) developed by the JRC to improve the forecasting of floods; this is being assessed as part of the Commission's European Flood Alert System. The aim is to provide four- to ten-day flood lead times (time between its announcement and arrival). This demonstrates how the JRC can convert research work into a quick response to an emergency situation.

***Prestige* tanker accident off Iberia.** In November 2002, a serious accident occurred with the oil tanker *Prestige*, which was sailing off the west coast of Galicia. Several thousand tonnes of its heavy fuel oil cargo spilled into the sea before the ship structure collapsed and the tanker broke into two some 160 km off the Spanish and Portuguese coast. In total, the ship had 77 000 tonnes of heavy fuel on board.

Following the incident, the JRC provided technical advice and support to the Civil Protection Unit of the Environment DG through interpretation and evaluation of radar satellite images – especially useful at night and in cloudy conditions. Image analysis allowed enhanced assessment and monitoring of the situation both at sea and along the coast. The JRC will continue to provide this information for as long as it is needed.

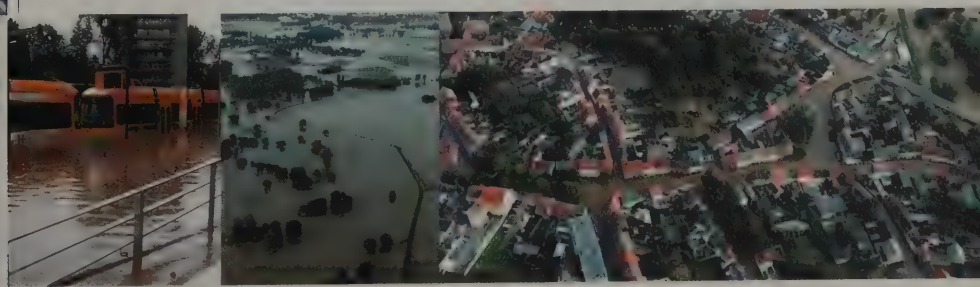
Factory explosion in Toulouse, France. The explosion at the AZF factory in Toulouse in September 2001 claimed 30 lives, injured over 2000 people, and devastated a city area of over 1 km in diameter. The economic impact of the accident will be in the order of hundreds of millions of euro. The Environment DG, the European Parliament, the Committee of Competent Authorities and the French Government requested the JRC to assist in drawing up "lessons to be learned" and strengthening regulations governing the use of ammonium nitrate – in particular the Seveso II Directive (96/82/EC).

In response, the JRC organised an international workshop in 2002 on the storage and handling of ammonium nitrate. Its conclusions were directly introduced into an amendment to the Seveso II Directive. In addition, the JRC assisted the Environment DG in various Council working group meetings and also testified before the French national assembly at the enquiry into the Toulouse accident.



Area 250 km west of the Galician coast showing that oil is still coming up from the sunken tanker

Images taken during the Elbe flood in August 2002 illustrate the enormous spatial extent of this flood that has been classified as the biggest flood of the last centuries in this area (air photos copyright of pik-potsdam.de). The effects for both rural and urban areas are only too obvious.



Prospective studies on enlargement

In 2002, the JRC Enlargement Project was refocused according to the demands of the Lisbon process. The project examines the main drivers of change specific to the integration of the candidate countries, and analyses the challenges to enhance competitiveness and sustainable development in an enlarged EU. Based on the JRC's own scientific achievements and its neutral foresight on scientific and technical developments, the aim of the project is to inform European policy-makers and the public about the significant results of scientific and technical research.

This project has been actively supported by the candidate countries, which provided most of the panel and steering group members and offered venues for the main meetings. This project has also promoted the affiliation of candidate country organisations to the European Science Technology Observatory (ESTO) with the result that five such organisations have already signed up as members. This membership will significantly facilitate and enhance JRC specialised studies required for EU Enlargement.

In 2002, this project produced a wealth of study reports that were published by the JRC. The second phase of the project focused on three thematic blocks relevant to the Lisbon/Gothenburg/Barcelona process, in which the candidate countries will participate fully once they join. These are:

1) The Competitiveness Agenda, dealing with economic aspects and the knowledge society, employment, employability and skills and social cohesion aspects;

2) The Sustainability Agenda, focusing on the set of structural indicators agreed by the European Council to monitor the implementation of the EU Sustainable Development Strategy; and

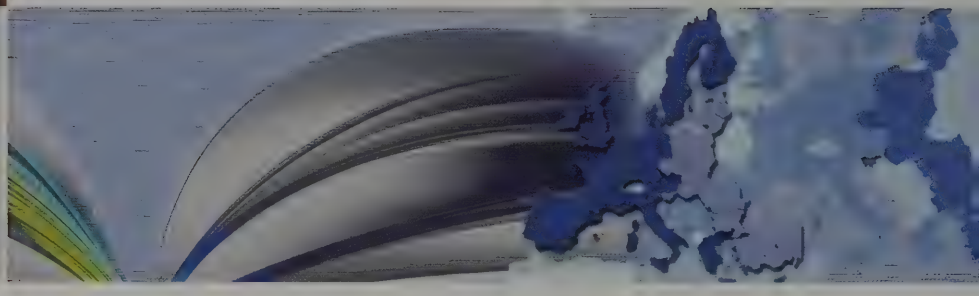
3) Agriculture in Transition, dealing with structural change, technological developments, competitiveness and the multi-functionality of the agricultural sector.

The results were presented and discussed in Warsaw in November 2002; all information on these and other prospective studies are available at: http://www.jrc.es.

Further results of the second phase were to be presented in Greece in May 2003 and at a final conference in Italy in November 2003.



JRC at the launch of the Sixth Framework Programme (FP6), Brussels, November 2002





JRC staff provide S&T expertise in all areas of the Tacis and Phare programmes aimed at improving nuclear safety in the Central and Eastern European Countries and Newly Independent States

Safety of Central- and Eastern-European nuclear reactors

Electricity generated by nuclear power plants accounts for more than one-third of total EU electricity production. However, the life distribution of this energy source is such that by 2005, 70% of current nuclear power plants will be over 20 years old. For this reason, continuous monitoring, surveillance and research are vital to ensure that safety standards are maintained both within, and in close proximity to, the EU.

With over 40 years of experience and competence in the field, the JRC continues to develop advanced technologies, harmonise procedures and practices, and merge, consolidate and disseminate R&D activities and knowledge at the European level.

Currently, the JRC is engaged in plant management studies of ageing nuclear installations through several European networks. It also provides technical and scientific expertise in all areas of the PHARE and TACIS nuclear safety programmes devoted to the improvement of nuclear facility safety in Central and Eastern Europe, Russia, the Ukraine and Armenia. Within its Enlargement Action, the JRC contributed to improving the safety of nuclear reactors in the candidate countries. For example, the TRANSURANUS fuel performance code, developed by the JRC, is in use in eight Eastern European countries. It is applied to the analysis of the thermal and mechanical behaviour of fuel rods in Russian-type VVER reactors.

In 2002, extended analysis of all available water-cooled, water-moderated VVER-1000 pressurised water reactor vessel surveillance data, and studies of the effect of phosphorus, copper and nickel on irradiation embrittlement (via model alloys) were carried out, and the results published at International Atomic Energy Agency (IAEA) and NATO dedicated conferences. The JRC has also compiled the results of the latest Tacis projects and defined the terms of reference for a new project that aims to provide the Russian and Ukrainian nuclear power operators with conclusions on demonstrated safety margins and remaining expected lifetimes.

The JRC will continue to support organisations concerned with nuclear safety, especially the External Relations DG, the Enlargement DG and the Energy and Transport DG (the Nuclear Regulators Working Group). Together with the European Aid Co-operation Office, the JRC is helping to address one of the key challenges for the enlarged Europe – the establishment of an affordable, adequate and safe energy supply for European citizens.



The new Minor Actinide laboratory

Operating the telemanipulators



New Minor Actinide laboratory fosters innovation in nuclear waste management

Nuclear waste management is one of the top priorities of the Euratom Sixth Framework Programme and thus the Commission is committed to supporting the search for safe solutions to nuclear waste management. To contribute to the quality of European research in this field, the Commission inaugurated a new Minor Actinide laboratory at the JRC in September 2002. This laboratory will investigate and develop innovative ways to reduce the risks associated with the high radiotoxicity of a number of long-lived radionuclides, some of which remain toxic for up to several thousand years.

Long-lived radionuclides called "minor actinides" (elements such as neptunium, americium and curium) could be separated from the spent fuel and returned to a dedicated reactor for transmutation. Transmutation aims to transform these long-lived elements into less harmful nuclides by significantly decreasing their radiotoxicity.

The Minor Actinide laboratory has been especially conceived to manufacture and characterise the most suitable materials for the transmutation of long-lived radioactive elements. This new laboratory consists of a series of shielded cells designed to protect the operators from neutron and gamma radiation emitted by these radiotoxic elements. For the same reason, the materials will be handled with telemanipulators, robots and through applying extensive automation with remote control. The main purpose is to bring the radiotoxic elements into a suitable matrix, which can then be safely introduced into a research reactor for transmutation.

At a cost of € 10 million, the new Minor Actinide laboratory will be one of the major infrastructures within the European Research Area contributing to several projects in the field of waste management. In addition, on the day of the inauguration, a "Memorandum of Understanding" was signed with the Commissariat à l'Energie Atomique (CEA) in France – the first element in the foundation of a European network in this field.

Non-proliferation and nuclear safeguards

The JRC 's nuclear safeguards activities aim to support a Euratom Treaty obligation entrusted to the Commission to ensure a continuation of the Community's outstanding security record in maintaining efforts to avoid nuclear weapons proliferation. New challenges have been introduced with the enlargement of the Union together with the need of safeguarding material arising from the disarmament process, the fight against illicit trafficking of nuclear materials and/or the emergence of new technological developments. The JRC has been working with the Energy and Transport DG (Euratom Safeguards Office) and through the External Relations DG with the International Atomic Energy Agency (IAEA) to strengthen the nuclear safeguards system by providing scientific, technical and training support. In the context of TACIS, the JRC co-operates with the Russian Federation in its quest to have a system of nuclear materials accountancy and control that is comparable with Western standards.

In 2002, an "Unattended Measurement Station" for the verification of fresh uranium fuel assemblies was developed and installed by the JRC at a fuel-fabrication plant in France. Combining both measurement and optical identification techniques, it can be left unattended for 100 working days. It was designed for both plant operation and inspection and guarantees a high level of safeguards while preserving the industrial productivity of the plant. Furthermore, methods for analysing samples originating from advanced fuels and from new types of fuel cycles were developed in the JRC. They include calorimetry examination for the assay of plutonium oxide and contribute to both process development and improved safeguarding of advanced fuel cycles.

In 2002, a significant effort was invested in the control of reprocessing facilities. The JRC continued to operate the on-site laboratories at the large plants at Sellafield (UK) and La Hague (France). Almost 1000 samples taken by Euratom inspectors in these facilities were analysed to provide independent evidence that no material had been diverted. Such measurements require very accurate isotopic reference materials and the large-dried spikes prepared in the JRC now form a basis for most of the destructive assays performed at nuclear reprocessing plants throughout the world. Mass and volume monitoring equipment has been installed to assist the Japanese safeguards authorities in verifying the flow of nuclear material. In the context of non-proliferation, swipe samples collected by IAEA inspectors in nuclear installations have been analysed using particle analysis techniques in order to verify the absence, or possibly detect the presence, of undeclared nuclear activities.

Advanced surveillance systems and imaging techniques for geographical information systems have been developed to assist IAEA inspectors in the verification of nuclear site declarations. Finally, techniques for nuclear forensic investigations were refined, in particular in view of the determination of the age of uranium and of the origin of material.

To conclude this summary of 2002 activities, much emphasis was given to combating illicit trafficking of nuclear and radioactive materials, and the candidate countries, in particular, were helped to set up response plans in case of nuclear material seizure. Specific training was also provided to experts from law enforcement and from radio-analytical laboratories and essential measurement instruments were supplied for on-the-spot categorisation. The JRC will continue, in the Sixth Framework Programme, to provide scientific, technical and training support for strengthening nuclear safeguards.

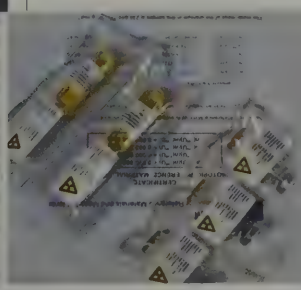
Preparing plutonium samples for age determination



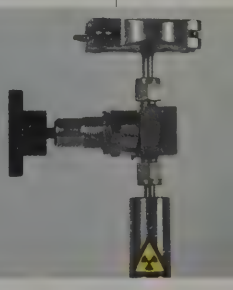
Sealed ampoules containing large dried uranium and plutonium spikes

Sealed quartz ampoules containing a uranium isotopic reference material

Uranium hexafluoride isotopic reference material for accurate measurements of uranium isotope ratios







Scientific excellence

Employing over 2000 people, the JRC has an active policy of attracting bright and able scientists. Staff come from across the EU, and from countries which have applied for EU membership, bringing their skills and talents to help resolve current scientific challenges. Major advantages are offered by the scientific and cultural diversity in the JRC's multi-disciplinary Institutes and collaboration networks with Member State and candidate country organisations. As a result, many JRC grant holders obtain direct employment in their home countries and, indeed, elsewhere in Europe and the world, following their training period in the JRC.

The JRC Scientific Committee assesses and awards prizes to JRC young scientists for both performance and publications. The results of this year's assessment are documented below







Awards to JRC young scientists

Francesca Campolongo,
Young JRC Scientist of the Year

Scientific overview:
During her career at the JRC, Francesca produced original theoretical scientific work in the field of mathematical modelling, and in particular on uncertainty and sensitivity analysis of model output. While doing her PhD, she developed, implemented and tested a new sensitivity analysis method to estimate second-order effects, based on mathematical graph theory. She also carried out an inter-comparison of different sensitivity analysis methods and drew conclusions on "when to use what". Francesca applied sensitivity analysis to several environmental models (models for fish population dynamics, models involved in climate change, etc.) and contributed to the improvement of these models and to the understanding of the phenomena being studied.

In 2002, she focused on the exploitation of sensitivity analysis techniques in a field that has not been fully exploited yet – that of financial risk assessment and management. With her colleague, Alessandro Rossi, she published work describing how sensitivity analysis can be a valuable tool to help solve the problem of hedging a financial portfolio. Together with Alessandro and officers of the European Investment Bank, she produced a working paper describing an efficient accounting procedure to assist the bank treasury system to perform bank accounting in accordance with international standards.

In the past year, Francesca has been working for the Internal Market DG in providing scientific and technical support to update the European Directive on Capital Adequacy (CAD3) for European banks and investment firms.


Francesca Campolongo

Background:
Francesca joined the JRC as a trainee in 1996 and went on to complete her postgraduate training in Ispra. Since 2001, she has been a staff member.

Francesca graduated in Applied Mathematics at the University of Pisa, Italy in 1993. In 1994, she was awarded two scholarships from the Australian Government and moved to Griffith University (Brisbane, Australia) where, in 1998, she completed her PhD in modelling and sensitivity analysis at the Faculty of Environmental Sciences. Her PhD was co-supervised by Andrea Saltelli, a member of the JRC staff, who hosted Francesca in Ispra for two six-month periods to supervise her research. Whilst doing her PhD, in 1995 Francesca spent a month at Cornell University (New York, USA) where she was selected to participate in an international summer school (limited to 20 participants) on ecological modelling. Since 1998, she has been working in Ispra developing research on sensitivity analysis and applying the most advanced techniques to a variety of different problems (e.g. environmental models, and models for financial risk assessment and management).

"In my experience the JRC is an excellent environment for young scientists. Not only have we the opportunity to improve our skills and scientific knowledge by working closely with outstanding researchers, but we also enjoy our working time because the JRC is a multicultural friendly environment."

Presentation of awards to the 2002 JRC young scientists



Maurice Whelan,
Award for scientific innovation

Scientific overview:
Maurice is author of eight international patents and in 1999 was joint recipient of the UK Department of Trade and Industry award for "Metrology for World Class Manufacturing". He joined the JRC in 1994 as a post-doctoral fellow and later became a staff member. Currently, he is head of the biomedical optics sector of the JRC. He has contributed to raising the profile of biomedical technology in the scientific community and the horizontal aspects of his work are fruitful for other JRC projects, in particular chemical sensing and nanotechnology. As an expert in biophotonics, an area that is expected to expand rapidly in the next decade, he contributes to the JRC priority areas in health technologies, food safety and chemical substances, helping to improve the scientific basis for better exposure-based risk assessment. A highlight of 2002 was the granting of a US patent (No 6,393,315) related to a novel fluorescence imaging approach for early detection of disease, including cancer. A prototype endoscope for minimally invasive diagnostics should be ready for clinical trials in 2003.

Background:
Maurice graduated in 1990 from the University of Limerick, Ireland, with a degree in mechanical engineering. He went on to complete his PhD in computational and experimental stress analysis in 1994, having spent time at the University of Liverpool and University College Swansea. Since then he has worked in the field of applied optics, targeting his research in a number of different areas such as smart aerospace materials and structures, industrial inspection and process control, and the protection of historical buildings. His current research interests include laser techniques at the micro- and nano-scale, fibre optic sensors and medical imaging.

"Working at the JRC has allowed me to develop scientifically, enabling me to take on challenges in new and exciting fields of research."



Maurice Whelan



Janna Puumalainen

Janna Puumalainen,
Award for contribution to environmental research

Scientific overview:
Janna joined the JRC as a postdoctorate grant holder in 2000. Her scientific work aims to improve the knowledge base for environmental protection, improve biodiversity monitoring in Europe and gain better understanding of the causes and processes leading to the depletion of biodiversity. Her work paid particular attention to both forest biodiversity and the interactions between different land use forms such as forests and water systems or forests and agricultural areas. For instance, she assessed, for the first time, the state of forest biodiversity across Europe by using comparable national data.

In 2002, she was involved in the development of biodiversity monitoring approaches by using statistical and modelling techniques to integrate different kinds of data. She also joined the Biotechnology and GMOs unit, and currently works on biometrics related to genetically modified organisms and their monitoring in food, feed and the environment.

Background:
After completing her MSc in Forestry in 1994 at the University of Joensuu, Finland, Janna went on to complete her PhD at the Institute of Forest Growth and Management at the University of Göttingen. She then joined the JRC in 2000 to complete her postdoctorate training in the Land Management unit. To date, Janna has pursued her career in no less than six countries, namely Belgium, Finland, Germany, Ireland, Italy and South Africa.

"The opportunity to work on an integrated research project at the JRC is unique, because you profit not only from the diversity of the topics, ideas and scientific backgrounds but also from the diversity of the people and culture."

Awards for best publications

Best scientific publication of the year

"Determination of Deforestation Rates of the World's Humid Tropical Forests" (in *Science*)

Frédéric Achard, *Hugh D. Eva, Hans-Jürgen Stibig, Philippe Mayaux, Javier Gallego, Timothy Richards*, Jean-Paul Malingreau (all except T. Richards are JRC scientists)* Science 297, 999 (2002).



Frédéric Achard

Scientific overview:

A recently completed research programme (TREES) employing the global imaging capabilities of Earth-observing satellites provides updated information on the status of the world's humid tropical forest cover. Between 1990 and 1997, 5.8 ± 1.4 million hectares of humid tropical forest were lost each year, with a further 2.3 ± 0.7 million hectares of forest visibly degraded. These figures indicate that the global net rate of change in forest cover for the humid tropics is 23% lower than the generally accepted rate. This result affects the calculation of carbon fluxes in the global budget and means that the terrestrial sink is smaller than previously inferred.

This new data will help reduce uncertainties in the global carbon budget, as well as providing accurate baseline views for biodiversity assessments and help in planning strategies for sustainable forest management. Through this project, a sound basis for forest monitoring in the tropics has been established and important new data concerning this valuable global resource were produced.

Background:

Frédéric completed his studies as an "ingénieur polytechnicien" in 1984 and graduated with a Masters degree in Image Processing from Strasbourg University in 1986, a PhD in tropical ecology and remote sensing from Toulouse University in 1989, and a "Habilitation à diriger des recherches" from the latter university in 1997. Having first worked in optical remote sensing at the Institute for the International Vegetation Map (CNRS/University) in Toulouse, he later became a seconded national expert from the French Ministry of Agriculture and Forest to the JRC in Ispra. Here he started a research activity over Southeast Asia in the framework of the "TRopical Ecosystem Environment observations by Space" (TREES) project. Having joined the JRC in 1992, his current research interests include development of Earth-observation techniques for global and regional forest assessments and monitoring.

"The working conditions in the TREES project were highly satisfying especially in terms of human environment and competencies. The TREES group reached scientific excellence, in particular through efficient co-operation with a large number of external partners both in Europe and the tropics."

* *Non-JRC scientist from Conservation Technology Limited, UK*

Three innovative publications of the year

"Plutonium-based superconductivity above 18 K" (in *Nature*)

J.L. Sarrao, L.A. Morales*, J.D. Thompson*, B.L. Scott*, G.R. Stewart**, F. Wastin, J. Rebizant,* ***Pascal Boulet****, E. Colineau, and G. H. Lander.* Nature 420, 297 (2002).

Scientific overview:

Plutonium is a metal of both technological relevance, due to its nuclear instability and associated radioactivity, and fundamental scientific interest. Despite its acknowledged importance, the electronic structure of plutonium, which directly influences its metallurgical properties, is poorly understood. This work reports on the observation of superconductivity, for the first time of a plutonium compound, with a rather high transition temperature of about 18.5 K. This, and the related effects, would be of technological importance for applied superconductivity.

Background:

Having completed his PhD in uranium solid state chemistry at the University of Rennes in 1997, Pascal moved to the "Institute für Physikalische-Chemie" at the University of Vienna where he completed his postdoctorate research in rare-earth based compounds studies. Obtaining a three-year European Marie Curie Grant, Pascal joined the JRC in 1999 and is currently working on the "Synthesis of new Transuranium Compounds – Crystallographic Study (powder and single crystal)".

"Working with the JRC is most stimulating and gives you the possibility to collaborate with people from all over the world."



Pascal Boulet

* *Non-JRC scientist from Los Alamos National Laboratory, USA*

** *Non-JRC scientist from Los Alamos National Laboratory and the University of Florida, USA*



Jean Galy

"Fission of actinides using a tabletop laser" (in *Europhysics Letters*)

Heinrich Schwoerer, Friederike Ewald*, Roland Sauerbrey*, Jean Galy, Joseph Magill, Vincenzo Rondinella, Roland Schenkel and Tilman Butz***. Europhysics Letters 61, 47 (2003)

Scientific overview:

This publication was the first demonstration of nuclear fission using a high repetition rate tabletop laser. The JRC set up the fission experiment and performed the radiation measurements to demonstrate the fission process. Jean has played a key role in three projects running at the JRC. In the project on laser-induced nuclear reactions, experiments demonstrated the first fission of thorium using a high-intensity laser, and confirmed the fissioning of uranium and thorium using a giant pulse VULCAN laser. Furthermore, Jean has investigated a neutron booster concept, for which the JRC now has a world patent and played a key role in developing the "nuclides.net" commercial computer package for computations on radionuclides and their radiation.

Background:

Jean graduated in 1991 (Baccalaureate) at Aix-en-Provence and went on to do a Masters degree in Physics at the University of Marseille (1995). After obtaining a one-year postgraduate diploma in Reactor Physics, he moved to Sweden to work on experimental nuclear physics and defended, in parallel, a Swedish Licentiate in Nuclear Physics at the Uppsala University. His PhD at the University of Marseille in 1999 was awarded by the French Nuclear Society (SFEN). In 2000, he joined the JRC as a postdoctoral fellow and is now working as an auxiliary agent.

"Working with the JRC provides many opportunities for innovative research in an international environment. Excellent facilities and networks of collaboration with scientific experts throughout the EU encourage my involvement in exciting research and development."

** Non-JRC scientist from Jena University, Germany*
*** Non-JRC scientist from the University of Leipzig, Germany*

"Neutron-Induced Fission Cross Section of ^{233}Pa between 1.0 and 3.0 MeV" (in *Physical Review Letters*)

Fredrik Tovesson, F.-J. Hambsch, A. Oberstedt, B. Fogelberg**, E. Ramström**, and S. Oberstedt.* Physical Review Letters 88, 62502 (2002).

Scientific overview:

The energy-dependent, neutron-induced fission cross section of Pa-233 (Protactinium 233) has been measured directly for the first time with monoenergetic neutrons. This nuclide is an important intermediary in a thorium-based fuel cycle, and its fission cross section is a key parameter in the modelling of future advanced fuel and reactor concepts. A first experiment resulted in four cross section values between 1.0 and 3.0 MeV, establishing a fission threshold in excess of 1 MeV. Significant discrepancies were found with a previous indirect experimental determination and with model estimates.

Background:

Fredrik started his PhD fellowship with the JRC in February 2000. Having first become acquainted with the gas effects prevalent in ionisation chamber detectors, he quickly acquired the know-how on the experimental set-up, data analysis, the use of computer codes for neutron transport calculations and theoretical evaluation of the data. The experiments were conducted using the JRC's seven million volt Van de Graaff accelerator. Fredrik presented his results at the International Conference on Nuclear Data for Science and Technology, Tsukuba, Japan.

"Being a PhD fellow in the JRC has allowed me to work in an excellent research environment, with access to unique facilities and expert knowledge in the field. One of the core activities of the JRC Reference Laboratory for Neutron Physics is to provide basic nuclear data in support of waste treatment and advanced reactor concepts – taking part in this important task has been a truly rewarding experience."



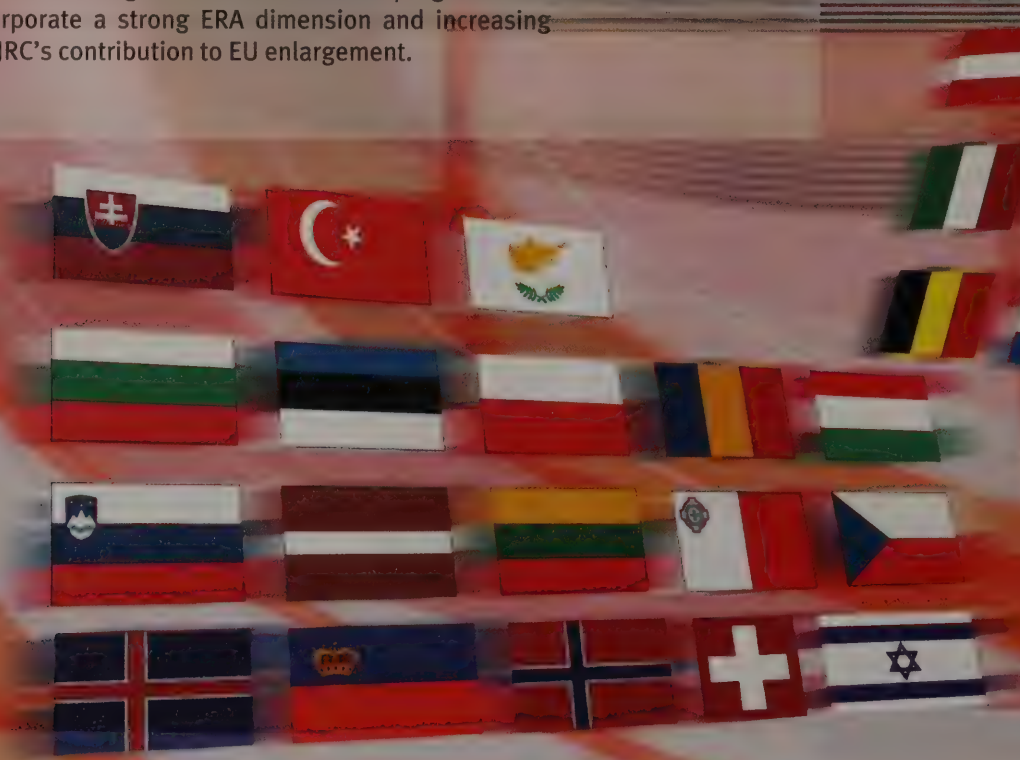
Fredrik Tovesson

** Non-JRC scientist from Örebro University, Sweden*
*** Non-JRC scientist from Uppsala University, Sweden*

Contributing to the European Research Area

The main objective of the European Research Area (ERA) is to strengthen the EU's position in international research through better organisation and integration of research activities in Europe. Promoting joint work between national laboratories and avoiding duplication of efforts is an important step towards building the ERA.

Mechanisms that fed into the JRC's contribution to ERA in 2002 included drawing up a concrete ERA action plan, structuring the multi-annual work programme to incorporate a strong ERA dimension and increasing the JRC's contribution to EU enlargement.



ERA Action Plan

Networking is at the heart of the European Research Area: it is the main instrument to tackle fragmentation and isolation of research activities and is the underlying tool of the Sixth Framework Programme (FP6) and its new research funding instruments. The JRC needs strong partnerships with public and private organisations in Member States and candidate countries in order to implement its mission, realise its work programme and deliver high-quality results. This collaboration is called for by the very nature of the JRC's work – harmonisation and validation of methods and measurements, establishment of common standards, and the provision of scientific and technical support in the implementation of European legislation.

The JRC also responds to European policy-makers' and Member States' increasing demands to establish common scientific reference systems. This allows the JRC to play a catalytic role in pulling together research efforts from Member States and candidate countries, helping the latter to rapidly integrate into the Community research scene and implement the acquis communautaire (body of EU law in the domains of competence of the JRC).

The ERA Action Plan was drafted in 2002 and sets ambitious targets for JRC's inclusion in the European Research Area by concentrating on five activities:

- Development and operation of Common Scientific Reference Systems;
- Increased networking with high-quality national and European organisations;
- Targeted multinational and multi-disciplinary training and mobility schemes;
- Extended access to and use of JRC research infrastructure, also for training purposes and
- Integration of enlargement activities into the JRC work programme, mainly through joint projects and training.

These activities complement each other and are often implemented in combination. For example, the use of mobility instruments to stimulate exchange of researchers is an important support measure for networking, and training through research benefits from access to infrastructure facilities. Networking with key players is necessary to provide the critical mass and scientific quality to build up scientific reference systems.

In 2002, the JRC recorded collaboration with more than 2000 partners in over 250 networks, access to JRC facilities increased, as did training and mobility schemes, and support to the enlargement process.





JRC Enlargement Workshop, Geel, November 2002

Support to enlargement

Enlargement of the European Union not only brings a wealth of different histories and cultures but also a population increase of 105 million people and a land area increase of 34%. On 29 October 2002, a total of 13 countries signed association agreements to the Sixth Framework Programme (FP6) – EU enlargement is now reality in the European Research Area. These candidate countries will have the same rights and obligations in FP6 as the Member States.

However, the Commission noted, in its latest progress reports, that additional preparation is still needed in certain policy fields, including customs service, air and water quality, waste management, veterinary and plant-health controls, and management and supervision of the agricultural policy. The implementation of such policies requires a strong scientific base and here the JRC is assisting and will increase its support in transferring relevant practices, references and know-how.

In FP5, the JRC opened up its work programme to include the candidate countries at a cost of € 20 million. Some 18 of its 80 projects were extended to the candidate countries allowing direct co-operation with scientific organisations in the areas of environment, nuclear safety and safeguards, harmonisation of measurements, support to the agricultural policy, food and chemical products, and prospective analysis and modelling.

In 2002, the JRC launched an additional programme called "Collaboration and advanced training" which resulted in 60 workshops and an active training programme that involved no less than 1200 scientists from candidate countries. Participants in this programme were nominated by the candidate country missions to the EU, with the help of the JRC National Contact Points. The result has been a marked increase in guest scientists, for example 33 visiting scientists in 2001 quickly grew to 67 in 2002 and a further increase to over 120 is expected for 2003. This action also increased candidate country participation in networks. At the start of FP5, candidate country partner representation in networks was minimal but quickly grew to a total of 270 by the end of 2002, i.e. already representing over 13% of the JRC's 2000 partners.

Based on the progress and experience gained in FP5, the JRC has drawn up a new project portfolio for FP6 in close collaboration with the newly established partners. Emphasis in the first two years will be on accelerating the uptake of the body of EU law. Workshops and training will incorporate new multimedia techniques for e-learning – such as a newly developed demonstration on GMO identification. New temporary-job openings for visiting scientists, seconded national experts and grant holders will also be sought (see www.jrc.cec.eu.int/enlargement).

The JRC's enlargement action is fulfilling the commitment of the Director-General to be "in the front line of this major European initiative".

Support to the GMES initiative

Harmonised geo-spatial databases allowing consistent and rapid integration of data from satellites are crucial to meet the needs of EU, governmental and private agencies dealing with issues such as environment, resource management, regional development, civil protection, research and security. The JRC has been involved in the development of data-gathering technologies and the harmonisation of databases for more than a decade now and has played a vital role in the foundation of the Global Monitoring system for Environment and Security (GMES).

GMES forms a key element in the overall European strategy for space. The initiative was established by representatives of the European Commission, the European Space Agency (ESA), the European organisation for the exploitation of meteorological satellites (EUMETSAT), the European Association of Remote Sensing Companies (EARSC), European industry and national space agencies.

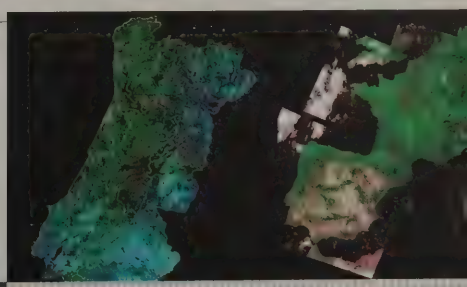
Satellite data on global land cover, burnt area and deforestation rates help in the study of climate change. The JRC collects indicators such as the recently supplied satellite-derived information on the status of the world's humid tropical forest cover (TREES project), contributing to a better understanding of the global carbon balance. Satellite data also plays an increasing role in crisis situations such as floods and forest fires: for example, European and national one- and three-day forest fire risk forecast maps are produced and transmitted to all civil protection and forest fire services in the Mediterranean region through a pre-operational user-driven service referred to as Fire Risk Watch.

Furthermore, the JRC hosts the World Data Centre for Aerosols for the World Meteorological Organisation, while an associated GMES project aims at integrating aerosol measurements from space and ground-based platforms.

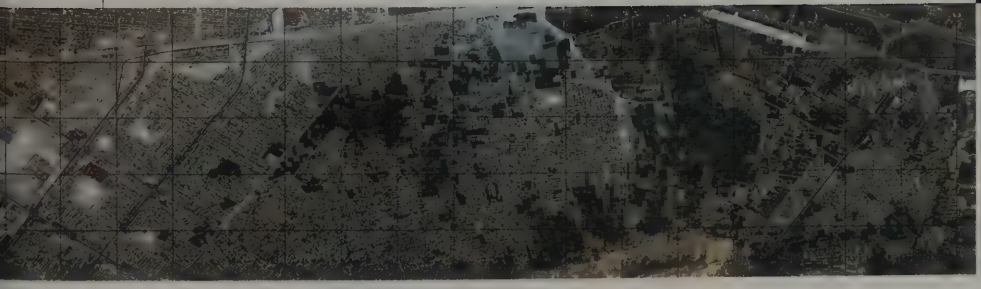
The JRC has developed methods for using satellite images to monitor agriculture with remote sensing (MARS) for the Common Agriculture Policy (CAP), to support the fight against fraud and provide crop-yield forecasts. High-resolution commercial satellite imagery, showing details of 1 metre or less, became available from 2000 and the JRC has been demonstrating the opportunities this offers for humanitarian aid, demining and damage assessment for reconstruction. Finally, it also contributes by verifying vessel positions for the Common Fisheries Policy.

To conclude, through its mission, the JRC helps in shaping GMES services and its capacity to respond more adequately to the needs expressed by other Commission services.

Forest fires in Portugal



Satellite image of Kabul city plan



FP6 and the multi-annual work programme

In 2002, the JRC prepared its multi-annual work programme for 2003 to 2006. This is in accordance with (1) the "specific programme of research, technological development and demonstration to be carried out by means of direct action by the JRC (2002-2006)" and (2) the "specific programme for research and training to be carried out by the JRC by means of direct action for the European Atomic Energy community (2002-2006)". The multi-annual work programme is organised according to four core areas, namely:

(1) Food, chemical products and health;
(2) Environment and sustainability;
(3) Nuclear safety and security; and
(4) Horizontal activities.

Within these core areas, eight thematic and three horizontal (technology foresight, reference materials and measurements, public security and anti-fraud) activities have been selected to represent the best match between policy needs and JRC competencies. Each priority is composed of a series of Integrated Scientific Areas (ISAs), which identify the particular aspects of the research covered by the JRC. This new structure is unique in that it is the first time ISAs, comprising activities from more than one Institute, are shared between the Institutes, aiming at enhancing the cohesion and focus of the JRC. These priorities reunite the JRC's activities with respect to the objectives of its mission, while the ISAs organise its competencies and streamline its interdisciplinary efforts around specific areas of work to draw on synergies from the research carried out in the JRC's specialised competency areas.

The ISAs and their content have been established in response to needs expressed and defined during consultations with JRC customers. Integration of research capabilities will ensure that the JRC achieves the required focusing of its activities on core priorities, an enhanced effectiveness in delivering high quality output through synergy and collaboration, and a significant level of involvement.

After a first round of in-depth internal discussions with the seven JRC Institutes, the multi-annual work programme was developed through extensive consultations with the JRC High Level Users Group (Directors-General of key policy DGs in the Commission), the JRC Board of Governors (representatives of the EU Member States together with participants from the candidate and associated countries) and with the Commissioner for Research, Philippe Busquin, and his Cabinet.



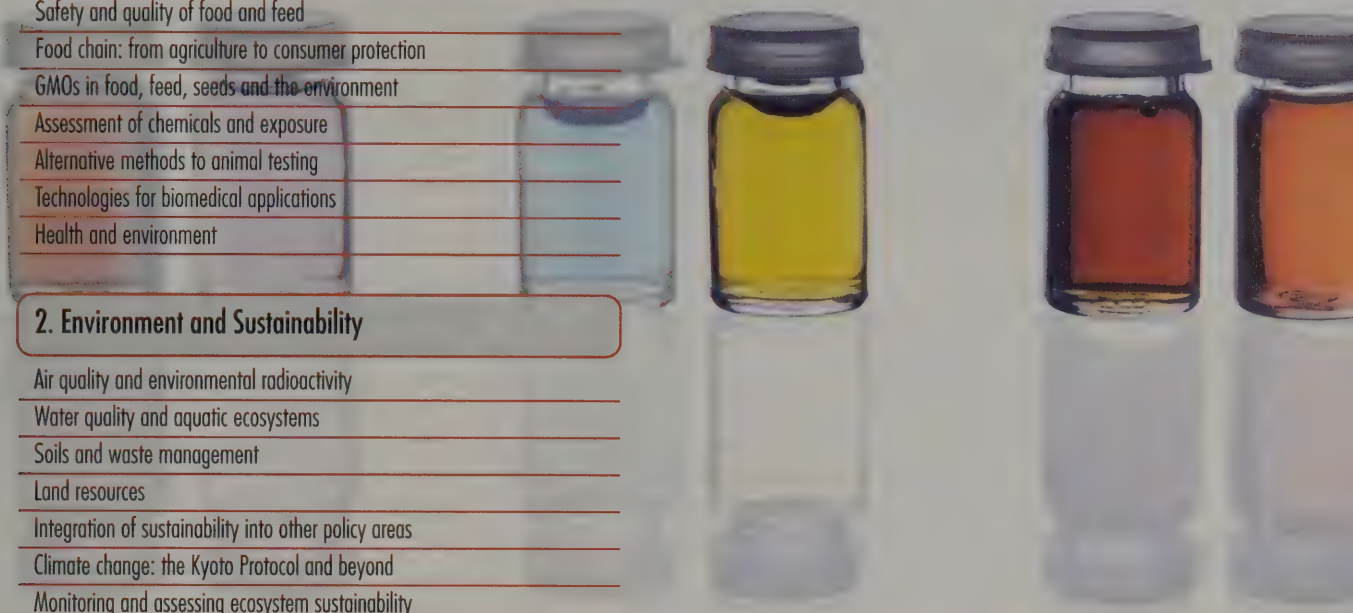


JRC at the launch of the Sixth Framework Programme (FP6), Brussels, November 2002

JRC activities for the Sixth Framework Programme

1. Food, Chemical Products and Health

- Safety and quality of food and feed
- Food chain: from agriculture to consumer protection
- GMOs in food, feed, seeds and the environment
- Assessment of chemicals and exposure
- Alternative methods to animal testing
- Technologies for biomedical applications
- Health and environment

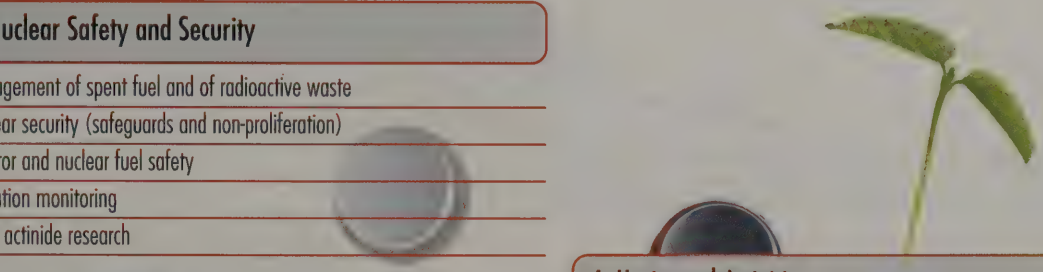


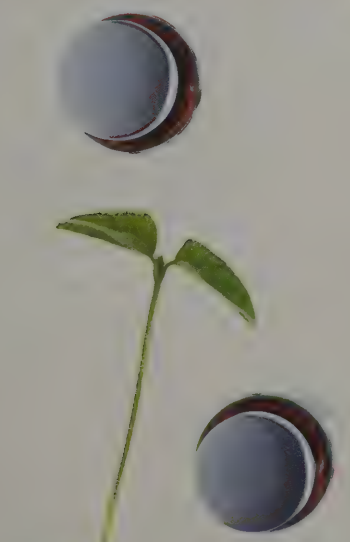
2. Environment and Sustainability

- Air quality and environmental radioactivity
- Water quality and aquatic ecosystems
- Soils and waste management
- Land resources
- Integration of sustainability into other policy areas
- Climate change: the Kyoto Protocol and beyond
- Monitoring and assessing ecosystem sustainability
- The Sustainable Energy Technologies Reference & Information System
- Renewable energies and advanced energy conversion technologies

3. Nuclear Safety and Security

- Management of spent fuel and of radioactive waste
- Nuclear security (safeguards and non-proliferation)
- Reactor and nuclear fuel safety
- Radiation monitoring
- Basic actinide research





4. Horizontal Activities

4.1 Technology Foresight

- Technology foresight in other JRC priorities
- Cross-cutting techno-economic foresight
- Statistical methods for analysis of economic indicators

4.2 Reference Materials and Measurements

- Reference materials and methods in other JRC priorities
- BCR (Bureau Communautaire de Référence) and industrial certified reference materials
- Metrology in chemistry and radionuclide metrology
- Metrology in physics: neutron data measurements

4.3 Public Security and Antifraud

- Antifraud and monitoring compliance with EU regulations in selected policies
- Support to cybersecurity
- Technological and natural risks
- Contribution to Commission objectives in humanitarian aid and assistance

Technology transfer

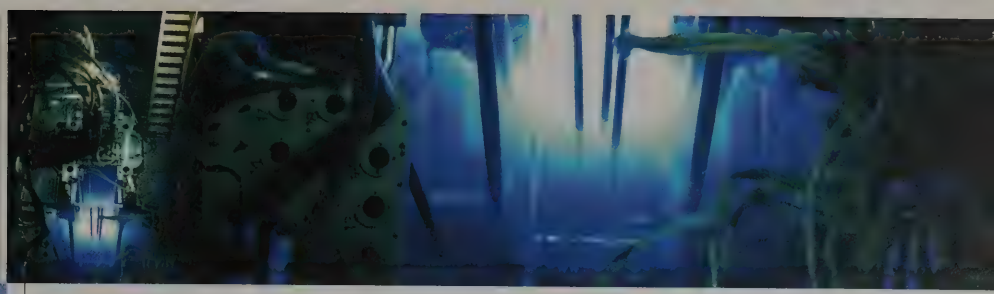
The JRC generates research results with commercial potential and, since March 2002, is responsible for managing the intellectual property – such as patents, trademarks and copyrights – of the European Union. To realise its potential, the JRC works with industrial partners to ensure the commercialisation of innovation. A key aim for the European Research Area (ERA) is to change attitudes and raise awareness, both with public institutions and within the Commission, of the commercial potential of such research results.

In recent years, the JRC has sought to transfer the technologies developed by its staff in new ways that benefit European society. The instruments set up include provision of entrepreneurship training and advice for spin-off company creation. The Centre also took part in a consortium of European public research organisations that work together to develop expertise in spin-offs and technology transfer. Since all the organisations face similar constraints in developing this aspect of their activities, they can assist each other in providing focused advice and support activities for their researchers.

For would-be entrepreneurs, regulations require that such researchers leave the service of the Commission before establishing independent enterprises, but many are deterred by the lack of knowledge of business processes. Therefore the JRC organises entrepreneurship courses and, in 2002, ten people received practical training in basic management skills and new business planning. Two new companies were formed, and the launch of several others is being prepared.

Of around 130 patented inventions owned by the Communities, about 90% are generated by the JRC. In 2002, JRC researchers filed 17 new applications for patents and software copyrights. Recent patent and licensing successes include a plasma treatment apparatus to reduce infection caused by medical devices, fibre optic sensors to yield information on the deformation of engineering structures and an interactive multimedia tool for computations involving radio-nuclides and their radiation.

Patent title	Patent number and granting date	
Differential curvature transducer	US patent granted on 15/10/2002	N° 6465800
Procédé et dispositif de synthèse d'hologrammes	US patent granted on 05/02/2002	N° 6344909
Procédé de fabrication de noyaux d'identité pour des sceaux à ultrasons	European patent granted on 06/03/2002	N° 1042746
Capsula para la identificación de ruminantes	Mexican patent granted on 18/04/2002	N° 981679
	US/B patent granted on 05/11/2002	N° 6474263
Improvements in or relating to test apparatus	European patent granted on 17/07/2002	N° 944819
Seismic wave simulation apparatus	European patent granted on 20/02/2002	N° 0944846
Improvements in or relating to specimen testing apparatus	European patent granted on 02/05/2002	N° 0886770
Dispositif de détection de rayonnement thermique et appareil de détection de présence à base d'un tel dispositif	European patent granted on 23/10/2002	N° 0876682
Camera ultrarapide pour visualiser le profil d'intensité d'une impulsion laser	Canadian patent granted on 14/05/2002	N° 0678218
Method of improving the contrast of images obtained using the pulsed image-addition ESPI technique	US patent granted on 26/03/2002	N° 6362873
Procédé de détection et de cartographie de zones enflamées de tissus vivants et dispositif pour sa mise en oeuvre	US patent granted on 21/05/2002	N° 6393315
Luminous Intensity Sensor Element and Light Beam Modulating Method and Device Employing such a Sensor Element	US patent granted on 2/07/2002	N° 6414782
Device and Method for Measuring Deformation of a Mechanical Test Specimen	European patent granted on 12/06/2002	N° 0893669
Multidirectional mandibular distractor	European patent granted on 16/01/2002	N° 832613
Kontaktlose Photovoltaik-Energieauskopplung	European patent granted on 06/03/2002	N° 907210
High performance centrifugal cells	US patent granted on 30/04/2002	N° 6379828
Apparatus and Method for Tritium Measurement by Gas Scintillation	European patent granted on 29/05/2002	N° 0754305
Method and apparatus for preparing Bi-213 for human therapeutic use	US patent granted on 26/11/2002	N° 6485695
Method for the quantitative determination of the fissile material content in small size particles	US patent granted on 01/10/2002	N° 6459747
Ex-corpore method for treating human blood cells	European patent granted on 04/09/2002	N° 0842668
Fernmessung von U (Pu) in Glaesern	US patent granted on 4/06/2002	N° 6400787
Modifizierter Kernbrennstoff	European patent granted on 06/02/2002	N° 0855083
A drive mechanism for transporting a tow at constant speed	Norwegian patent granted on 29/04/2002	N° 312357



Top view of core and side pool facility at the High Flux Reactor Unit



View of the High Flux Reactor, Petten

The High Flux Reactor supplementary programme

The High Flux Reactor (HFR) supplementary programme, financed by France, Germany and The Netherlands, is managed by the JRC. The HFR, located in Petten, The Netherlands, is one of the most powerful multi-purpose research and test reactors in the world and today its operation has been entrusted to the Nuclear Research and Consultancy Group (NRG). Having provided irradiation and post-irradiation examination services for over three decades, in recent years its mission was extended to medical support both through the production of radioisotopes and patient treatment at the Boron Neutron Capture Therapy Facility (BNCT). Today, the HFR is the European leader in terms of radioisotope production volume.

In 2002, additional indications on weld anomalies discovered in the summer 2001 inspection led to serious concerns about plant safety. Thus, on 8 February 2002, the Commission, in agreement with NRG and the Dutch nuclear safety authority, the "Kernfysische Dienst" (KFD), decided to temporarily shut down the reactor. The shutdown of the HFR raised major concerns for the continued supply of medical radioisotopes, and the issue was raised during an emergency debate in the Dutch Parliament in February 2002.

This shut-down period was used for an external safety culture review performed by an International Atomic Energy Agency (IAEA) expert group, the implementation of improvement actions and an external inspection of the welding anomaly found in weld 22 of the reactor vessel during the summer 2001 inspection. The IAEA review concluded that the reactor was in good condition and made recommendations and suggestions for further safety improvements. As a consequence, a programme on safety culture improvement was set-up and an external inspection of the welding anomaly allowed the reactor to start again on 22 March. Operations have continued normally since then. A new service inspection will take place in the summer of 2003.

Decommissioning of JRC nuclear installations

The management of nuclear installations, built for the purposes of the Euratom Treaty, falls under the responsibility of the Commission throughout their complete life spans until they are decommissioned. To comply with the Euratom Treaty, the Commission – and thus the JRC in each of its establishments – applies national and EU legislation concerned with the transport, processing, temporary storage and final disposal of nuclear materials, as well as the safety and security regulations applicable to nuclear installations and materials. In accordance with this legislation, the JRC is committed to protect both the public and the environment from radiological hazards and is thus required to decommission and shut-down nuclear installations and manage the associated waste.

To this end, the JRC has developed a Decommissioning and Waste Management (D&WM) programme. This D&WM programme is managed in each JRC establishment by a specialised team, under the review of the D&WM Expert Group, which is composed of external experts designated by Member States and chaired by the Deputy Director-General. The objective of the programme is to plan, support and supervise the progressive elimination of the JRC's historical liabilities, including obsolete nuclear facilities and waste management installations. The ultimate goal is the return of the obsolete facilities to a state where no radioactive hazard remains, thus allowing reuse both of the land and of the buildings for non-nuclear purposes.

The present status

In 2002, decommissioning of the radiochemistry building at the JRC site in Geel, Belgium was completed and, on 11 October, Commissioner Busquin inaugurated the reopening of this building for research in food, health and environment related issues. At the JRC site in Karlsruhe, Germany, main activities in 2002 concerned the dismantling of some 30 gloveboxes and the characterisation of nuclear waste. At the Ispra site, progress was made in the provision of waste management facilities. The setting up of a transit store, including weighing station and portals, for clearance of the materials has been completed and both characterisation and clearance plants progressed to a very advanced stage – both plants will be completed in early 2003. The decontamination plant and the station for the treatment of liquid effluents have both been equipped with heating, ventilation and air-conditioning systems and, for the latter, the programme for hot commissioning has been prepared and sent to the authorities for approval. Finally, treatment plants were equipped with fire detection/prevention systems, radiation monitoring equipment, etc., and the design and safety reports on the final two facilities have also been prepared.

A significant milestone was reached in pre-decommissioning activities. The inventory of nuclear/strategic material has been further minimised by transferring 23 tonnes of heavy water (i.e. half of the inventory) to Canada. More than 200 tonnes of waste from the hot cells, reactors and other facilities have been released after checking and/or decontamination. Finally, in the field of licensing/safe conservation, the approvals for the removal of additional components, such as aerial pipelines, were received.

The decommissioning programme was initially launched in 2000 and now, two years later, a decision was taken to review the situation both in terms of assessing the technical content and financial implications. Thus, in 2002, a European consortium led by the Belgian Nuclear Centre (SCK.CEN) was entrusted with this task. The report, available early in 2003, will be submitted to the relevant Advisory Bodies (Expert Group and Board of Governors).

In 2003, the JRC will continue with the decommissioning programme and will prepare a new Communication to the European Parliament and Council on an updated programme.

Heavy water storage



Factory acceptance test of waste characterisation system conveyor



The JRC in figures

Staff

The core staff of the JRC (M-male, F-female) is composed of the following categories:

Staff (end-of-year situation)	2001 M	2001 F	2001 Total	2002 M	2002 F	2002 Total
Officials	589	161	750	714	235	949
Temporary agents on 5-year renewable contracts	588	205	793	458	154	612
Temporary agents on 3-year non-renewable contracts	77	38	115	64	17	81
TOTAL	1254	404	1658	1236	406	1642

Of the above-mentioned total, 1311 staff members can be considered as scientific staff. During the course of the year, the total number of staff fell by 16, the number of departures exceeding the number of new recruits. In 2002, the Commission policy for staff financed on the research budget was modified in accordance with the White Paper on Commission Reform that has called for the "integration of research staff into the mainstream of the Commission's personnel policy". The objective of this policy is to reach 65 to 90% of the total statutory staff as officials and to keep a margin of flexibility of between 10 and 35% of permanent research posts for the recruitment of specialised staff to cope with needs that are strictly time-limited.

Staff distribution (end-of-year situation)	2001 M	2001 F	2001 Total	2002 M	2002 F	2002 Total
Institute for Reference Materials and Measurements	127	40	167	127	41	168
Institute for Transuranium Elements	170	40	210	175	40	215
Institute for Energy	128	24	152	130	24	154
Institute for the Protection and Security of the Citizen	194	50	244	184	51	235
Institute for Environment and Sustainability	210	60	270	193	56	249
Institute for Health and Consumer Protection	88	54	142	100	58	158
Institute for Prospective Technological Studies	43	15	58	39	17	56
DG, Scientific Strategy and Resources Directorates	294	121	415	288	119	407
TOTAL	1254	404	1658	1236	406	1642

Visiting staff

In addition to its core staff, the JRC also hosts grant holders, visiting scientists, seconded national experts, auxiliaries and trainees coming from the Member States, candidate countries or elsewhere.

While visiting staff are attracted by the JRC's cultural diversity, its multi-disciplinary Institutes and collaboration networks, they, in return, bring their skills, knowledge and expertise to help resolve the current scientific challenges. The JRC strategy to increase its number of visiting staff was achieved as reflected through the figures below.

Visiting staff	2001 M	2001 F	2001 Total	2002 M	2002 F	2002 Total
Trainees	23	34	57	31	22	53
Postgraduate grant holders	50	35	85	53	51	104
Postdoctoral grant holders	66	22	88	60	29	89
Visiting scientists	16	8	24	19	5	24
Seconded national experts	23	6	29	18	6	24
Auxiliaries	96	115	211	141	156	297
TOTAL	274	220	494	322	269	591

Equal opportunities

Since 2000, the JRC has taken a markedly proactive stance with regard to promoting equal opportunities and, in particular, gender equality in its working environment. A JRC-wide network on Women and Science that includes representatives from all JRC Institutes and Directorates was set up.

During 2002, the JRC launched a call for applications for JRC training through research grants and, among the selected young researchers, the 40% target for JRC female grant holders was exceeded. For the first time, gender parity was almost reached for the postgraduate grant holders.

Recruitment of women at the JRC in grades A8/A7/A6 in 2002 was increased to 32% and, in March 2002, the JRC adopted a code of good practice concerning maternity leave replacement.

Budget (budget and expenses – institutional activities)

The available credits to the JRC are subdivided in staff expenses, means of execution (maintenance of buildings and equipment, electricity, insurance, consumables, etc.) and operational credits (direct scientific activities).

The credits come from the institutional budget, made available directly from the European budget to the JRC for the Fifth Framework Programme. On the institutional budget, the following sums were committed:

In million euro (M€)	2000	2001	2002
Staff expenses	160	160	163
Means of execution	49	49	49
Operational appropriations	50	40	38
TOTAL (rounded)	**259**	**249**	**250**

In addition to these appropriations, a total amount of € 10.2 million was made available to finance an action programme to reduce and dispose of nuclear liabilities resulting from activities not directly linked to research conducted by the Joint Research Centre since its establishment. It is intended to cover the decommissioning of plants that have been shut down and wastes from such plants.

Additional sources of appropriations are made available through contributions of Central and Easter European countries (CEEC) and EEE (associated countries of Central and Eastern Europe, Cyprus, Malta and EFTA) (€ 15.3 million in 2002), and competitive activities.

Competitive activities

The table below shows the values of contracts signed and inscribed into the 2001 and 2002 accounts.

Contracts signed	2001	2002
Shared-cost actions	14.1	2.3
Competitive activities outside the Framework Programme	9.3	13.8
Third party work	11.4	5.2
TOTAL	**34.8**	**21.3**

The € 2.3 million for shared-cost actions reflects the conclusion in the year 2002 of 19 newly signed contracts. This decrease is a consequence of the last year of the Fifth Framework Programme (FP5) and the reduced number of calls for proposals in 2002.

Competitive activities outside the Framework Programme include additional paid work for Commission services which is not covered by the JRC's own work programme. Fifty-eight new contracts were signed in 2002 for a total amount of € 13.8 million – an increase of € 4.5 million compared to 2001.

Third party work up to a value of € 5.2 million was committed for a range of 68 major clients. This considerable reduction in income, as compared to 2001, is nevertheless congruent with annual fluctuations for third party work and reflects a general trend to earn additional income through providing S&T support to Commission services beyond the JRC's work programme.

JRC 2002 publications by Institute

INSTITUTE	EUR reports	Articles	Conference papers	Special publications*	TOTAL
General Management	2	2	3	56	63
IRMM	17	75	126	12	230
ITU	1	67	86	17	171
IE	8	17	80	18	123
IPSC	13	35	130	47	225
IES	63	112	283	38	496
IHCP	26	67	135	26	254
IPTS	28	14	62	10	114
TOTAL	**158**	**389**	**905**	**224**	**1676**

** Special publications: public relations documents, technical notes, bulletins, newsletters, manuals, internal management reports, proceedings, theses, electronic documents.*

Appendices

Appendix 1: Members and participants of the JRC Board of Governors

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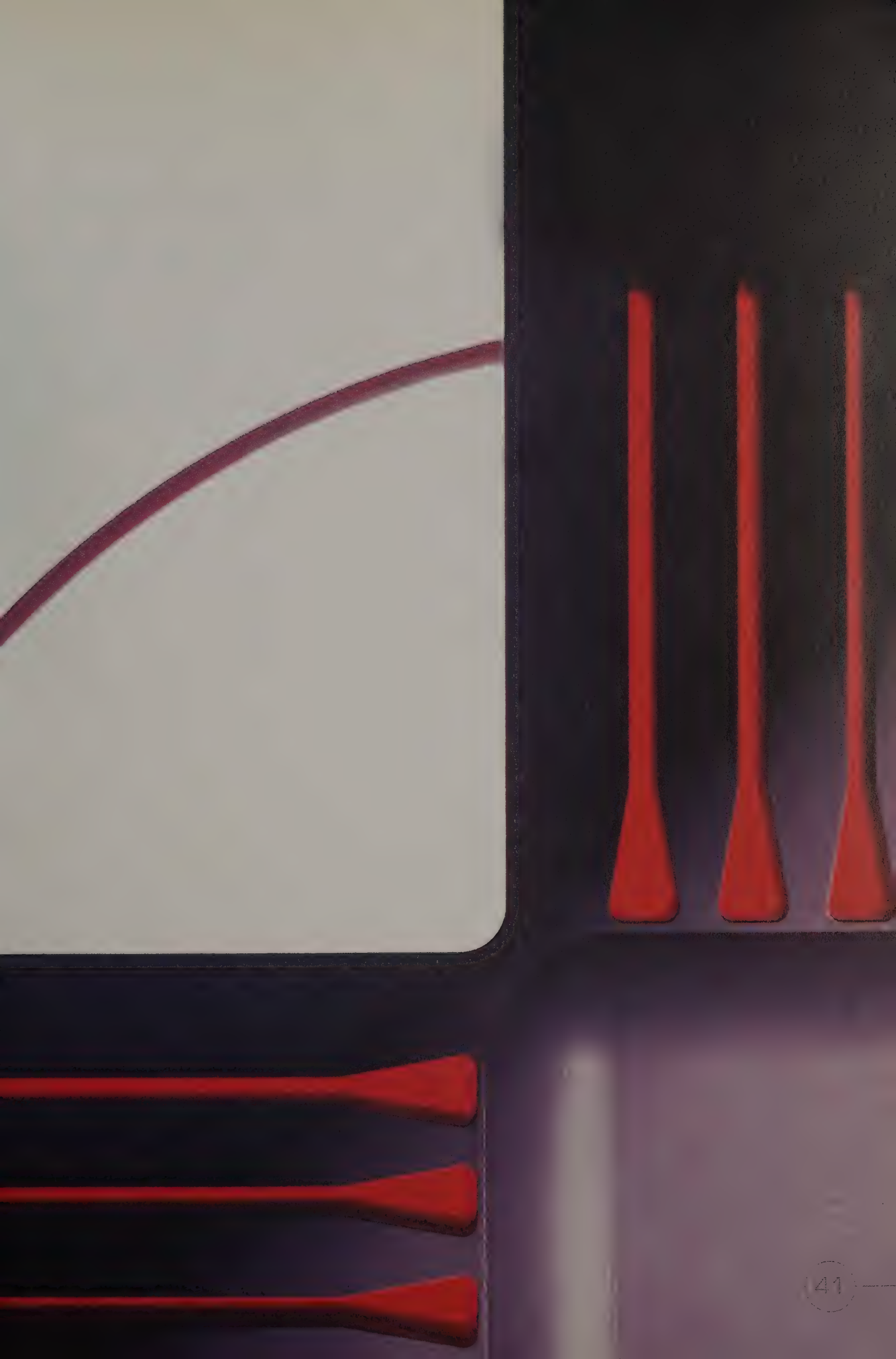
Science Strategy Directorate
David R. Wilkinson



Resources Directorate
Jean-Pierre Vandersteen



Principal Advisor for Science and Technology
Jean-Marie Martin



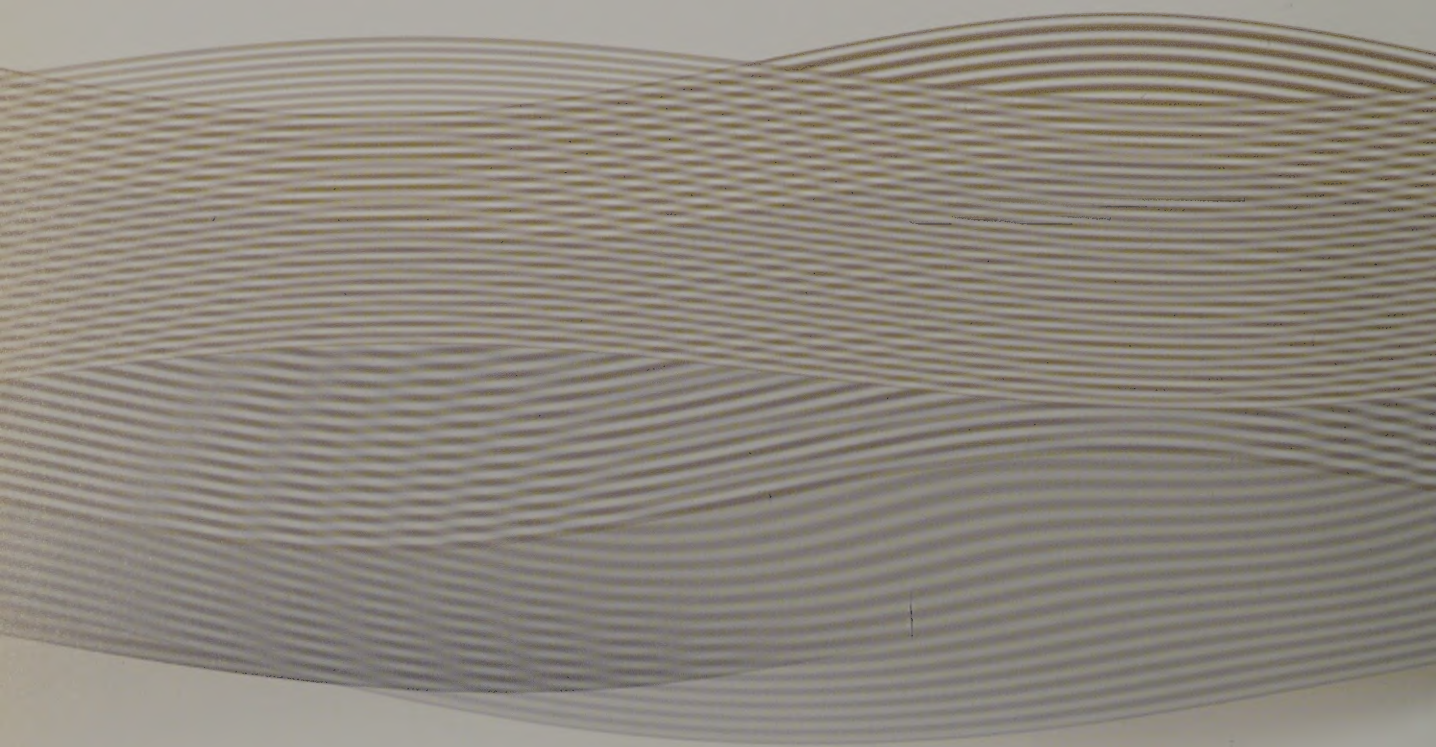
European Commission

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Abstract

Report on the activities, accomplishments and resources related to the JRC work carried out in 2002. An overview is given of the mission and its implementation, the scientific activities and the relations with the outside world.





15 KJ-NA-20-659-EN-C

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Community. Close to the policy-making process, it serves the common interest of the Member States, while being independent of commercial or national interests.



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